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SEED COTTON and MULTIPLE LINT CLEANINGS at GINS

Effect on Grade, Price, and Bale Value

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A Progress Report

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PREFACE

This report is one of a series relating to different combinations of cleaning and conditioning equipment at gins. It is primarily concerned with the effect on grade and bale value of one through four stages of lint cleaning in combination with different levels of seed cotton cleaning. Earlier studies dealing with the effect on one and two stages of lint cleaning are referred to in footnotes in this report.

Results of related studies, dealing with the effect of cleaning practices upon fiber properties and manufacturing performance, are reported in Marketing Research Reports No. 269 and 486.

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SUMMARY AND CONCLUSIONS

At the gins studied, a combination of three lint cleaners and a moderate overhead setup gave somewhat higher bale values than other cleaning combinations, although the differences at one gin were not statistically significant. Differences in bale values related to overhead setups were not consistent and generally were not significant. At one gin, no significant increases in bale values resulted from the use of one lint cleaner, but highly significant increases occurred with the use of two or more. At the other gin, with the exception of the combination of three lint cleaners with an elaborate overhead cleaning setup, each added step in the lint cleaning process resulted in a significant increase in bale values.

These general findings are based on an analysis of 153 bales of machine-picked cotton sampled during the 1960-61 ginning season at two commercial gins in the Midsouth. The study was designed to determine the influence of different combinations of overhead and lint cleaning equipment on trash removal, price per pound, grade, and bale values. The premiums and discounts prevailing at the time of the study were used in arriving at bale values. It should be borne in mind that different results may be obtained in other seasons and in other areas. Moreover, the evaluation made in this study does not take into account the amount and distribution of the additional cost of these services or their effect on the value of the lint for mill purposes.

Other results of the study show that, with both moderate and elaborate overhead setups, the range in grades of lint was very wide for both gins when no lint cleaner or only one was used. However, with three or more lint cleaners the range in grades was narrowed to only two full grade steps.

Lint cleaners in combinations of two or more appeared to be very effective in removing grass from ginned lint. Of the 45 bales sampled at Gin No. 1, 30 percent were reduced in grade because of grass before any lint cleaning. With the use of three or more lint cleaners, none of the bales were designated as grassy.

With no lint cleaning or only one, price per pound of cotton processed at both gins was significantly higher with the elaborate overhead setups than with the moderate setups. For Gin No. 1, however, there appeared to be no difference in price per pound between setups if more than one lint cleaner was used. Price per pound at Gin No. 2 was significantly higher for the elaborate setup than for the moderate setup when no lint cleaning was done, or when one or two cleaners were used. However, when three lint cleaners were used there were no significant differences between overhead cleaning setups in price per pound.

At both gins, the foreign matter content of ginned lint appeared not to differ significantly between overhead cleaning setups when three or more lint cleaners were used.

The difference in bale weights between overhead setups ranged from 6 pounds with four lint cleaners to 8 pounds with no lint cleaning at Gin No. 1 and from 7 pounds with three lint cleaners to 12 pounds with no lint cleaning at Gin No. 2. At both gins, the differences in bale weights between overhead setups were the same with either two or three lint cleaners.

SEED COTTON AND MULTIPLE LINT CLEANINGS AT GINS-- EFFECT ON GRADE, PRICE, AND BALE VALUE

A Progress Report

By Zolon M. Looney, Agricultural Economist, Marketing Economics Division, Economic Research Service, and Edsel A. Harrell, Agricultural Engineer, U. S. Cotton Ginning Research Laboratory, Agricultural Research Service

INTRODUCTION

Use of lint cleaners in cotton gins is a relatively recent development. As recently as the 1948-49 ginning season, lint cleaners were in operation in only 28 commercial gins in the United States. 1/ However, in 1954-55, almost one-third of the Nation's gins (processing more than half of the entire crop) were equipped with these machines.

Another recent development is the use of multiple lint cleaners in series. At least a few gins used this equipment during the 1955-56 ginning season. Of the approximately 6,800 active gins in the United States in 1956-57, one-half were equipped with lint cleaners, and 207 of these had two stages of lint cleaning. 2/ The number of gins with two lint cleaners increased rapidly in the 1956-59 period, largely as a result of competition among gins. This trend has been especially evident in the areas of highly mechanized production of cotton. Also, during this period ginners began to install equipment for a third lint cleaning. By the 1960-61 season, 4,900 of the active gins were equipped with lint cleaners; 45 percent of these gins had two cleaners and 5 percent had three. At least one gin in the Midsouth was using four lint cleaners in series.

Tests of the lint cleaner developed by the U. S. Cotton Ginning Laboratory showed it to be effective in improving the grade of ginned lint. 3/ However, studies of lint cleaning conducted in commercial gins indicate that with only one lint cleaning the effects of grade improvements on bale values are often

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1/ Gerdes, F. L., Cotton Lint Cleaning at Gins - An Evaluation from the Standpoint of Quality and Economic Factors. U. S. Dept. Agr., May 1951, p. 2. (Processed.)

2/ Cotton Division, Agricultural Marketing Service. Cotton Gin Equipment, United States. U. S. Dept. Agr., 1957 and 1960. (Processed.)

3/ Stedronsky, V. L., and Shaw, C. S. The Flow-Through Lint-Cotton Cleaner. U. S. Dept. Agr., Cir. 858, Nov. 1950.

offset by loss in bale weight. 4/ A possible exception to this is the effect of lint cleaning on cotton classed as Light Spotted before cleaning. A study conducted at four commercial gins in Arkansas during the 1957-58 and 1958-59 seasons showed, however, that in the gins studied the use of two lint cleaners was almost sure to result in an increase in average bale values, especially when there was a relatively wide spread in price between Low Middling and Strict Low Middling and between Strict Low Middling and Middling cotton. 5/ This is accounted for by substantially greater improvement in grade and smaller losses of weight resulting from the second lint cleaning than from the first.

When lint cleaners first came into general use, most gins processing machine-picked cotton were already equipped with elaborate overhead cleaning and drying equipment. In an effort to produce higher grades, the driers often were operated at high temperatures, resulting in overdrying as well as over-machining. When the first lint cleaners were installed, these ginning practices were generally continued. But as second and third stages of lint cleaning were added, many ginners and researchers decided that, with the use of lint cleaners, improved grades could be produced from machine-picked cotton with less seed cotton cleaning and with driers operated at lower temperatures. Thus, the problem was no longer one of merely deciding whether to add an additional stage of lint cleaning, but of arriving at a decision as to the best combination of seed cotton cleaning and drying with lint cleaners.

OBJECTIVE

The main purpose of this study was to determine, for machine-picked cotton, the influence of different combinations of cleaning and conditioning equipment on quantity of foreign matter removed, grade improvement, prices received, and bale values. It was recognized that the combination of equipment used may significantly influence fiber length distribution and other quality elements of cotton, and may also affect the costs of ginning and related services and the distribution of those costs. Information has not yet been developed on these effects, but it is anticipated that such information will be developed in more comprehensive studies planned for the near future.

SCOPE AND METHOD

Studies were made at two gins, both in the Midsouth. Two overhead or seed cotton cleaning and conditioning setups, referred to as elaborate and moderate, were used. In Gin No. 1, the elaborate overhead setup consisted of a full

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4/ Cable, C. C., Jr., and Looney, Z. M. Effects and Costs of Cleaning Lint in Arkansas Gins., Ark. Agr. Expt. Sta. Bul. 595, Dec. 1957. U. S. Dept. Agr., Agr. Mktg. Serv., cooperating.

St. Clair, J. S., and Roberts, A. L. Effects of Lint Cleaning of Cotton--An Economic Analysis at California Gins. U. S. Dept. Agr., Mktg. Res. Rpt. 238, May 1958.

5/ Looney, Z. M., and Ghetti, J. L. Effects of Tandem Lint Cleaning on Bale Values, Weight Changes, and Prices Received by Farmers. U. S. Dept. Agr., Mktg. Res. Rpt. 397, May 1960.

tower drier, 28 cylinders of cleaning and a bur machine (fig. 1), and the moderate overhead setup consisted of a full tower drier and 13 cylinders of cleaning. In Gin No. 2, the elaborate setup consisted of two full tower driers, three 7-cylinder cleaners, and a bur machine. The moderate setup consisted of one 7-cylinder cleaner and one tower drier. Gin No. 1 had four stages of saw-type lint cleaning and Gin No. 2 had three. In each plant, the normal ginning practice was to use all overhead and lint cleaning equipment when ginning machine-picked cotton.

Data analyzed in this report were collected during the 1960-61 ginning season. Samples of lint were drawn from 153 bales of machine-picked cotton before lint cleaning and after each successive lint cleaning treatment. During each visit a number of bales were sampled with all seed cotton cleaning and conditioning equipment in use. Approximately the same number were ginned with part of the seed cotton cleaning equipment bypassed. Thus, in the gin with 4 lint cleaners there were a total of 10 cleaning treatments--no lint cleaning and 1, 2, 3, and 4 lint cleaners in combination with 2 overhead treatments. In the gin with three lint cleaners, there were eight individual overhead and lint cleaner combinations to test.

The waste removed by each lint cleaner from a selected number of bales was weighed to provide an estimate of the effect of these cleaners on bale weight. A Shirley Analyzer test was made on each lint sample obtained to determine the differences in foreign matter content of ginned lint for each overhead and lint cleaning combination.

All of the cotton was ginned with a relatively high, and uniform, moisture content of lint. Grade designations of the cottons were determined by official cotton classers of the Cotton Division of the United States Department of Agriculture.

Choice A purchase prices were used in the analysis to show the effects of different combinations of overhead and lint cleaning on changes in price per pound and bale values.

GRADE DISTRIBUTION

In both gins, the grade of lint with no lint cleaning tended to be lower for the moderate than for the elaborate overhead setup (table 1). In Gin No. 1, the grades were virtually the same with two or more lint cleaners, regardless of overhead treatment. In Gin No. 2, the elaborate overhead setup produced somewhat better grades than the moderate setup, even with three lint cleaners. However, these differences were small and probably resulted from having only seven cylinders of cleaning in the moderate setup. The range in grades was very wide for both gins and both overhead setups when no lint cleaner, or only one, was used. With three or four lint cleaners, the range in grades narrowed to only two full grade steps.

None of the bales sampled were classed as Spotted and only a few as Light Spotted, even with no lint cleaning. All of the Light Spotted bales were classed as White after two lint cleaning treatments.

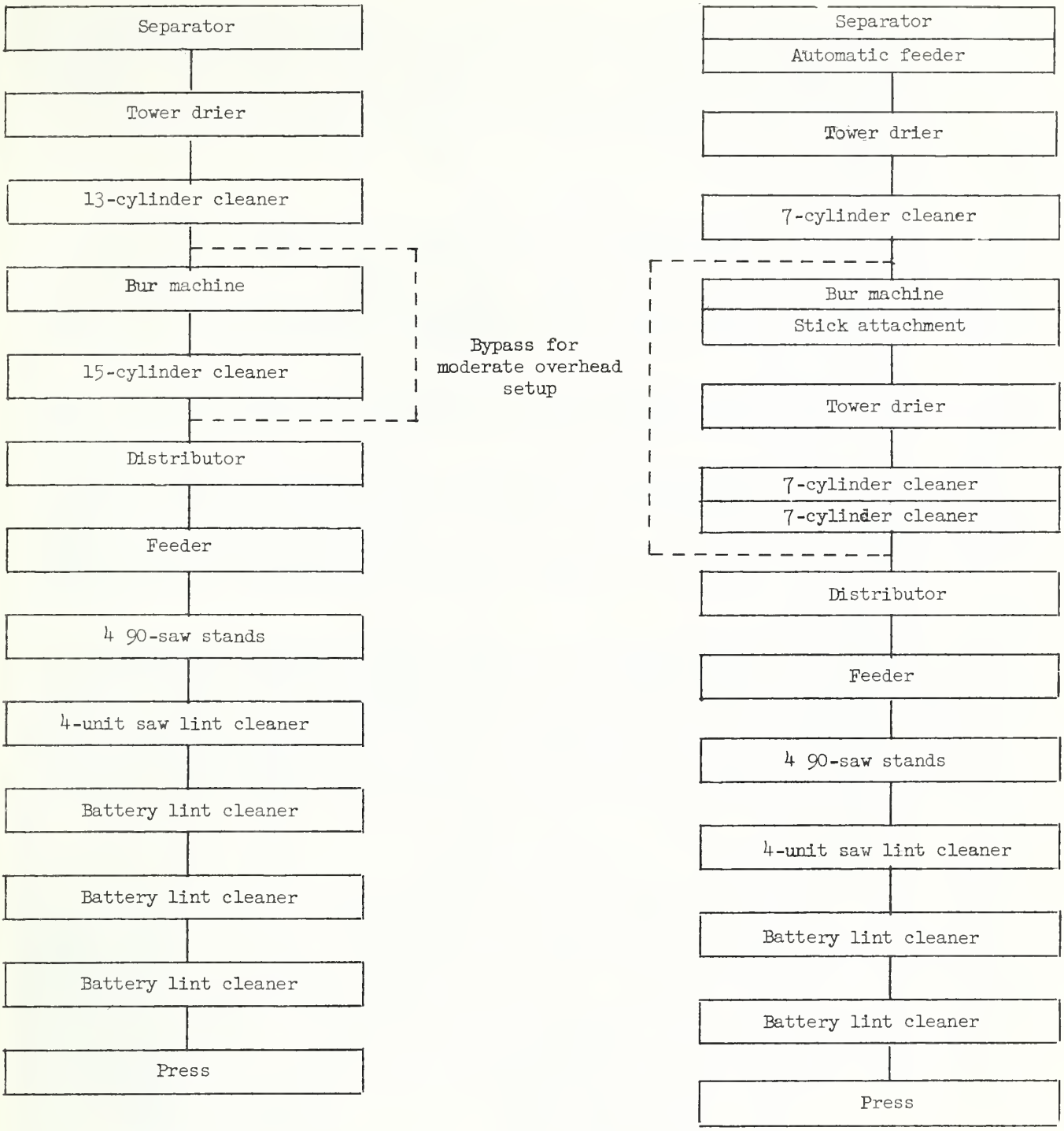

Figure 1.--Flow diagram

Table 1.--Distribution of bales by grade after ginning with specified combinations of overhead and lint cleaning equipment, 2 gins in Midsouth, 1960-61 ginning season

Grade after ginning	Proportion of bales processed with moderate overhead setup and following number lint cleaners					Proportion of bales processed with elaborate overhead setup and following number lint cleaners				
	None	1	2	3	4	None	1	2	3	4
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
GIN NO. 1										
Strict Low Middling	---	---	60	81	73	2	11	58	76	86
Low Middling Plus	---	7	22	11	20	9	11	11	4	7
Low Middling	29	47	16	8	7	45	49	25	20	7
Strict Low Middling Light Spotted	---	---	---	---	---	2	---	2	---	---
Strict Good Ordinary Plus	29	9	2	---	---	14	2	2	---	---
Strict Good Ordinary	34	29	---	---	---	22	20	2	---	---
Low Middling Light Spotted	4	4	---	---	---	4	7	---	---	---
Below Grade	4	4	---	---	---	2	---	---	---	---
Total	100	100	100	100	100	100	100	100	100	100
GIN No. 2										
Middling	---	---	24	39	---	---	30	47	57	---
Strict Low Middling Plus	---	9	12	9	---	3	---	---	---	---
Strict Low Middling	3	37	24	52	---	47	30	33	43	---
Low Middling Plus	40	21	34	---	---	7	---	17	---	---
Low Middling	15	24	6	---	---	30	33	3	---	---
Strict Low Middling Light Spotted	3	---	---	---	---	10	7	---	---	---
Strict Good Ordinary Plus	33	9	---	---	---	---	---	---	---	---
Strict Good Ordinary	3	---	---	---	---	---	---	---	---	---
Low Middling Light Spotted	3	---	---	---	---	3	---	---	---	---
Total	100	100	100	100	100	100	100	100	100	100

Since all cotton sampled was harvested in October, the color had not been adversely affected by weather. The wide range in grade found when no lint cleaner, or only one, was used resulted from many bales being reduced because of grass or extremely leafy conditions. Lint that went through two or more lint cleaners more nearly achieved its full color potential.

GRASS REMOVAL

One of the most difficult problems in cleaning cotton is the removal of grass. This is especially true when cotton is machine-harvested from heavily-infested fields. The presence of only small amounts of grass in ginned lint results in heavy penalties in grade. Seed cotton cleaning, even in elaborate setups, has not been too effective in removing grass.

Of the 45 bales sampled at Gin No. 1 when the elaborate overhead setup was used, 11 were reduced in grade because of grass before lint cleaning, and their grades were not improved by one lint cleaning (table 2). After two lint cleaning treatments, only one bale still showed enough grass to be reduced. With the moderate overhead setup, 16 out of 45 bales were reduced because of grass with no lint cleaning, and 17 after one lint cleaning. However, with this setup also, only one bale was reduced in grade because of grass after two lint cleanings. With use of three or more lint cleaners, none of the bales from either overhead setup were reduced because of grass.

The seed cotton sampled at Gin No. 2 contained very little grass. With no lint cleaning or one lint cleaning, only one bale processed with the elaborate overhead setup and two bales processed with the moderate setup were reduced because of grass. After going through two or more lint cleaners, none of these showed enough grass to be reduced. The saw-type lint cleaner in combinations of two or more appears to be very effective in removing grass from ginned lint.

EFFECT ON PRICE

When no lint cleaning and with one lint cleaner, the average price per pound of lint for all bales sampled in both gins was significantly higher for the elaborate overhead setups than for the moderate overhead setups (fig. 2). 6/ For Gin No. 1, when two, three, or four lint cleaners were used there appeared to be no significant differences in price per pound between overhead setups. With moderate overhead, the increase in price per pound between two lint cleaners and three or four lint cleaners was significant. With the elaborate overhead setup in this gin, the price per pound increased significantly from two lint cleaners to three. The difference between two lint cleaners and four was highly significant.

6/ Price difference (cents per pound) between treatments required for significance:

	Gin No. 1	Gin No. 2
At 5-percent level	0.41	0.46
At 1-percent level	.54	.60

Table 2.--Effectiveness of specified combinations of overhead and lint cleaning equipment in removal of grass from cotton, 2 gins in Midsouth, 1960-61 ginning season

Date of ginning	Moderate overhead setup						Elaborate overhead setup					
	Sample bales	Bales reduced in grade when using following number of lint cleaners					Sample bales	Bales reduced in grade when using following number of lint cleaners				
		None	1	2	3	4		None	1	2	3	4
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
GIN NO. 1												
Oct. 4	9	7	7	1	0	0	8	3	3	1	0	0
Oct. 13	12	3	4	0	0	0	12	4	2	0	0	0
Oct. 21	8	2	3	0	0	0	9	1	2	0	0	0
Oct. 26	12	4	2	0	0	0	12	3	3	0	0	0
Nov. 3	4	0	1	0	0	0	4	0	1	0	0	0
All bales	45	16	17	1	0	0	45	11	11	1	0	0
GIN NO. 2												
Oct. 3	12	0	0	0	0	--	11	0	0	0	0	--
Oct. 17	13	1	0	0	0	--	12	0	0	0	0	--
Oct. 28	8	1	0	0	0	--	7	0	1	0	0	--
All bales	33	2	0	0	0	--	30	0	1	0	0	--

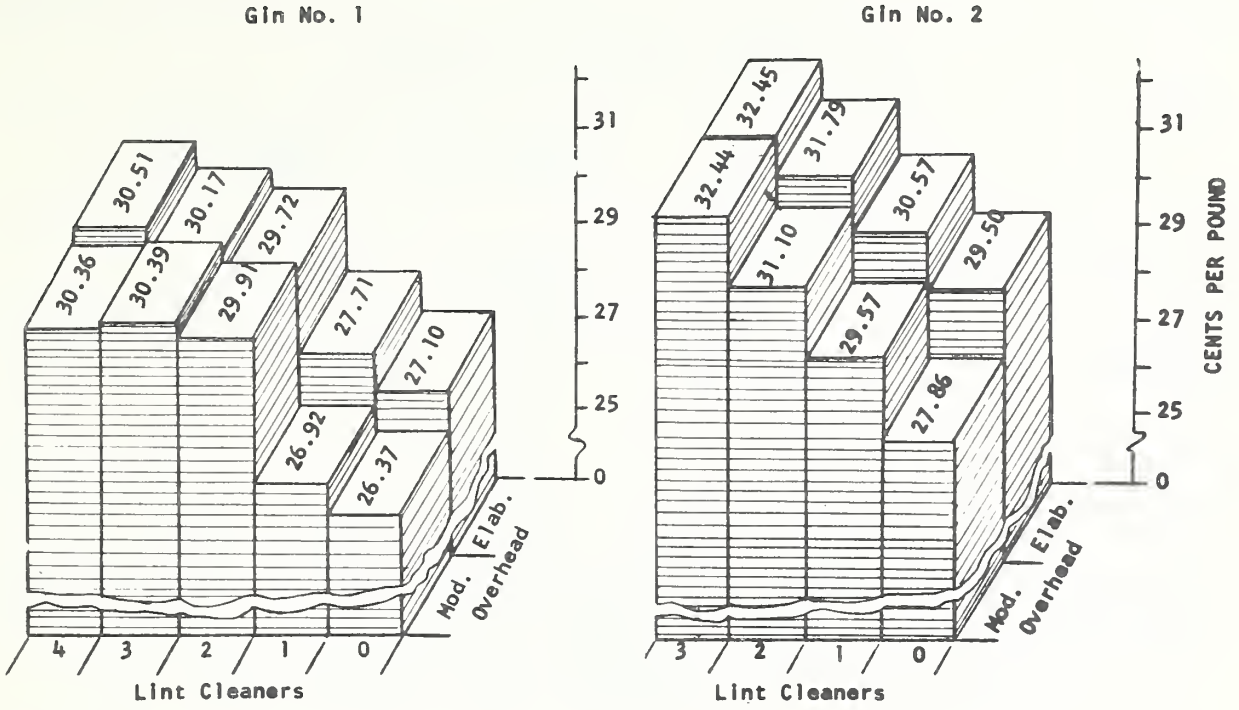

Figure 2.--Average price per pound of cotton, by specified gin treatments, two gins in Midsouth, 1960-61 ginning season

In Gin No. 2, cotton processed with the elaborate setup and with no lint cleaning or with one or two cleanings was worth significantly more per pound than cotton processed with the moderate overhead and the same number of lint cleanings. With use of a third lint cleaner, there appeared to be no difference between overhead setups. However, for both setups the third cleaning resulted in significant increases in price per pound.

FOREIGN MATTER IN LINT

There were substantial differences in foreign matter content of ginned lint between gins, as determined by the Shirley Analyzer, especially when less than three lint cleaners were used (table 3). These differences can be attributed to the fact that cotton received at Gin No. 1 had more trash than cotton received at Gin No. 2. The average foreign matter of the seed cotton on arrival was 5.8 percent for Gin No. 1, compared with 4.6 percent for Gin No. 2. At Gin No. 1, the foreign matter content of seed cotton at the feeder apron was 2.3 percent after going through the elaborate overhead setup; at Gin No. 2, it was 1.2 percent. After processing through the moderate overhead setup, the foreign matter content of lint was 3.0 percent at Gin No. 1 compared with 2.0 percent at Gin No. 2.

Table 3.--Foreign matter content of ginned lint, by gin treatment, 2 gins in the Midsouth, 1960-61 ginning season

Overhead setup	Foreign matter with following number of lint cleaners 1/				
	None	1	2	3	4
	Percent	Percent	Percent	Percent	Percent
Gin No. 1:					
Elaborate	4.85	3.39	2.22	1.81	1.33
Moderate	5.15	3.83	2.15	1.72	1.33
Gin No. 2:					
Elaborate	2.62	1.79	1.20	.85	---
Moderate	3.64	2.28	1.68	1.01	---

1/ Differences between treatments required for significance:
Gin No. 1: 1-percent level = 0.50; 5-percent level = 0.38
Gin No. 2: 1-percent level = 0.52; 5-percent level = 0.39

With 13 cylinders of cleaning in the moderate overhead setup in Gin No. 1, there was very little difference in nonlint content between overhead cleaning setups when two, three, or four lint cleaners were used. However, in Gin No. 2, where the moderate overhead setup consisted of only one 7-cylinder cleaner, the elaborate overhead setup appeared to produce significantly cleaner lint with two lint cleaners. With three lint cleaners the difference between overhead setups was not significant.

WASTE REMOVAL BY LINT CLEANERS

Generally, with lint cleaners of the same kind there is a reduction in the amount of waste removed at successive lint cleaner stages. However, in both Gin No. 1 and Gin No. 2, the first and second lint cleaners were of different makes, and for the bales sampled in this study the first and second lint cleaners removed approximately the same amount of waste (table 4). The difference between gins in waste removed by the first and second lint cleaners with the elaborate overhead setups probably results from the difference in foreign matter content of the cotton received at the gins. At successive early stages of lint cleaning, the ratio of actual trash to lint in the waste removed decreases.

Table 4.--Estimated waste per bale removed by lint cleaners, 2 gins in Midsouth, 1960-61 ginning season

Overhead setups	Lint cleaners			
	1	2	3	4
	Pounds	Pounds	Pounds	Pounds
Gin No. 1: 1/				
Elaborate	11	11	4	4
Moderate	11	11	5	5
Gin No. 2: 2/				
Elaborate	7	7	3	---
Moderate	10	8	4	---

1/ For Gin No. 1, all weights were corrected to 500 lbs. for 4 lint cleaners.
2/ For Gin No. 2, all weights were corrected to 504 lbs. for 3 lint cleaners.

BALE WEIGHTS

The amount of waste removed either by seed cotton cleaners or by lint cleaners is directly reflected in the final bale weights (fig. 3). The difference in bale weights of cotton processed with the elaborate and the moderate

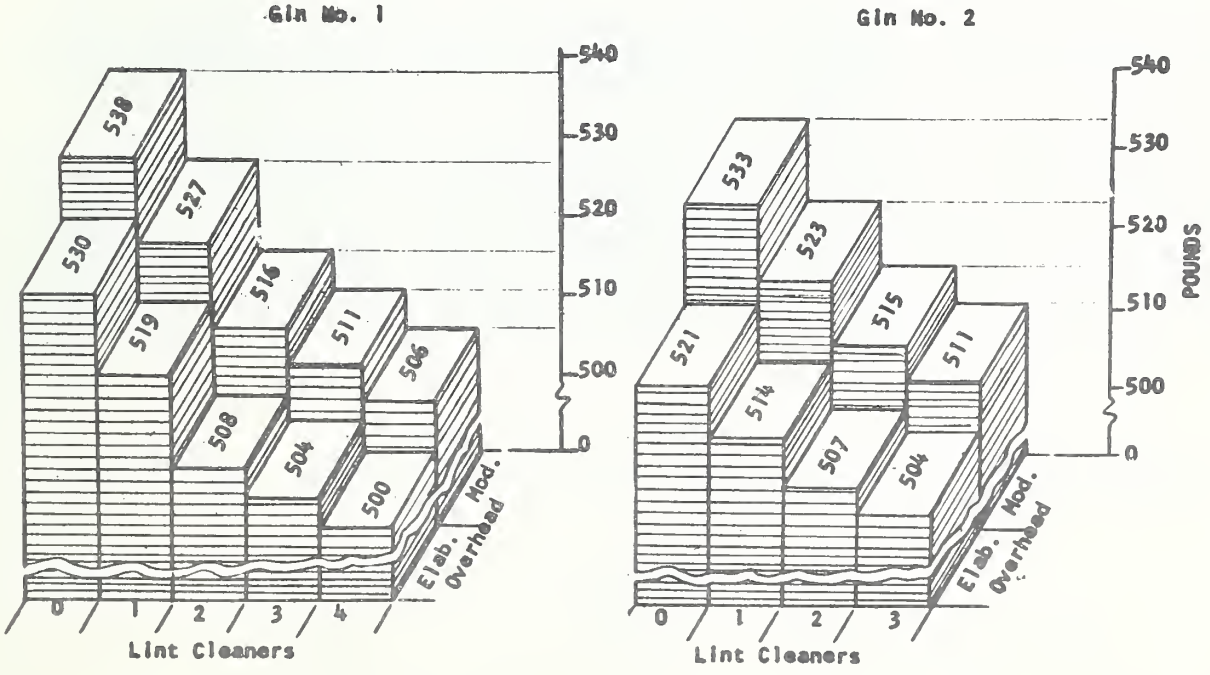

Figure 3.--Average weight per bale of cotton, by specified gin treatments, two gins in Midsouth, 1960-61 ginning season

overhead setups ranged from 6 pounds with four lint cleaners to 8 pounds with no lint cleaning in Gin No. 1, and from 7 pounds with three lint cleaners to 12 pounds with no lint cleaning in Gin No. 2. The differences in bale weights between the two overhead setups were the same for both gins with either two or three lint cleaners. However, the differences between overhead setups were greater for Gin No. 2 than for Gin No. 1 with one lint cleaner or no lint cleaning. This is probably accounted for by the fact that the fewer cylinders of cleaning in the moderate setup for Gin No. 2 left more foreign matter in the seed cotton as it was ginned. This increased the bale weight with one lint cleaning or none, by causing a higher trash content. This difference was largely overcome by two or three lint cleanings.

BALE VALUES

The effect on bale value of cleaning cotton before or after ginning is determined by differences in bale weights and in prices at the time of sale. Thus, with a narrow range in prices between grades, the weight loss associated with a specific cleaning practice may more than offset the influence of any grade improvement on the value of the bale. The appropriate price per pound for each grade and staple designation was applied to the corrected bale weights to obtain average bale values for each gin treatment studied.

For Gin No. 1, with neither the elaborate nor the moderate setup were there significant differences in bale values between no lint cleaning and one lint cleaning, or between the second and third or third and fourth cleanings (fig. 4). 7/ However, when compared with no lint cleaning or one lint cleaner, the use of the second lint cleaner resulted in highly significant increases in bale value for both overhead setups. With no lint cleaning, one lint cleaner, or four lint cleaners the differences in bale value between overhead setups were not significant. With two or three lint cleaners, however, the moderate setup gave significantly higher average bale values than the elaborate setup.

At Gin No. 2, the addition of the first two lint cleaners resulted in highly significant increases in bale value for both the overhead setups, while with three lint cleaners differences were significant for the moderate setup only. With no lint cleaning, the elaborate overhead setup gave significantly higher average bale values than did the moderate setup. However, with one, two, or three lint cleaners the differences in bale values between overhead setups were not significant.

7/ Difference in bale value (dollars per bale) between treatments required for significance:

	Gin No. 1	Gin No. 2
At 5-percent level	1.94	2.57
At 1-percent level	2.84	3.38

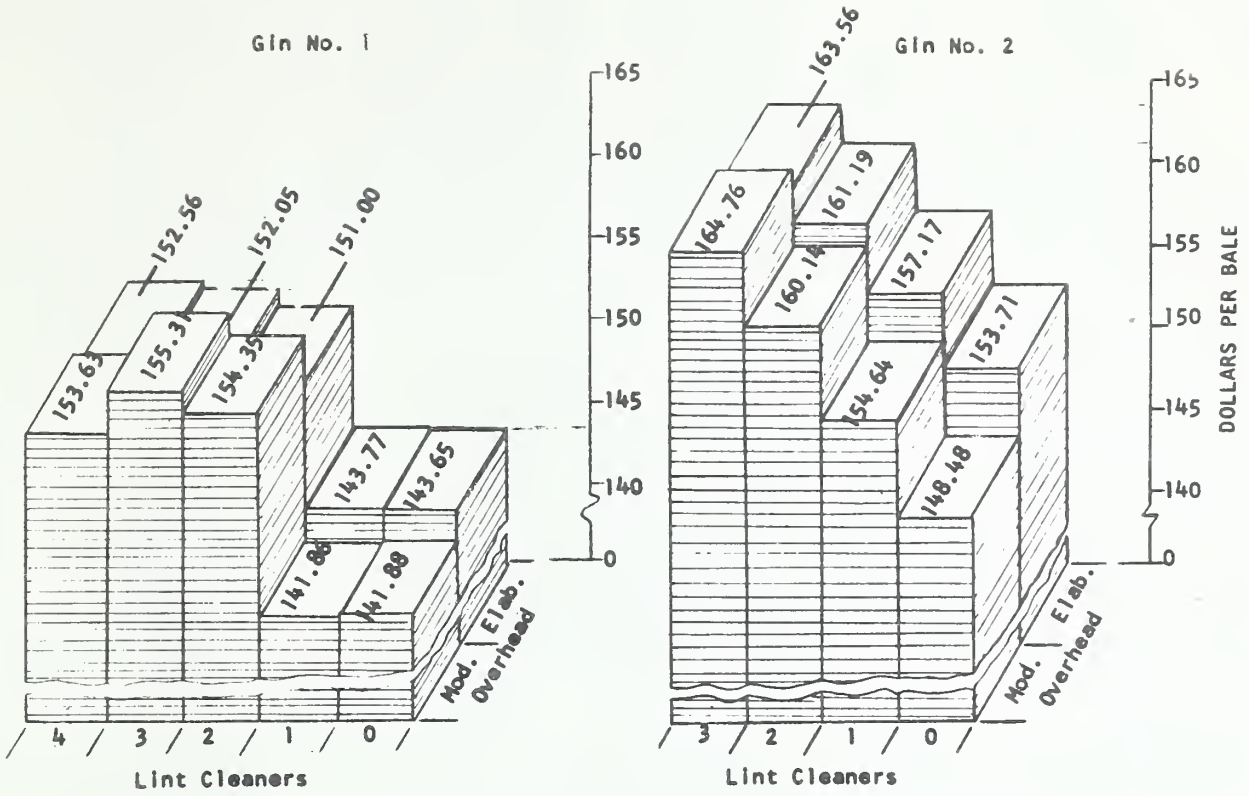

Figure 4.--Average value per bale of cotton, by specified gin treatments, two gins in Midsouth, 1960-61 ginning season

It is realized that, before making any final determination of the net benefits to be derived from the extensive use of lint cleaning equipment, it would be necessary to ascertain the cost of using the equipment, and any influence it may have on quality of fiber. Earlier studies indicate that costs for a single lint cleaner may amount to as much as $1.50 or more per bale. These costs may be passed on to producers as a special charge, or they may be added to and included with other ginning charges. On the other hand, the ginners may absorb the costs and use the service as a means of maintaining or increasing their volume of business. If passed on to producers, the costs would partly offset, or might equal or exceed any increase in bale value resulting from lint cleaning.